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A NEW CRAYFISH OF THE EXTRANEUS SECTION  
OF THE GENUS *CAMBARUS* WITH A KEY TO THE  
SPECIES OF THE SECTION (DECAPODA, ASTACIDAE)

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The Extraneus Section of the Genus *Cambarus* was diagnosed by Ortmann (1931:96) as follows: "Carapace more or less ovate, depressed, with or without lateral spines. Rostrum with marginal spines. Chelae not very elongated, depressed, and rather broad, but a little more elongated than in the sections of *bartoni* and *diogenes*. Areola more or less wide, and of variable, moderate length. Eyes well developed. The essential character is the *presence of marginal spines on the rostrum*." Within the group he included only two species, *Cambarus extraneus* Hagen (1870:73) and *Cambarus cornutus* Faxon (1884:120), and under the former he listed *Cambarus girardianus* Faxon (1884:117) and *Cambarus jordani* Faxon (1884:119) as synonyms. Only one additional species belonging to this Section has been subsequently described—*Cambarus rusticiformis* Rhoades (1944:133).

The ranges as well as the biology of all of these species are poorly known, and Ortmann's conclusions concerning the identity of the three that he combined under the name *Cambarus extraneus* deserve a careful evaluation based on many more specimens. On the basis of a study of additional specimens of Faxon's *C. jordani*, it seems that Ortmann was in error in concluding that "the single known individual of *jordani* is nothing but one of the many individual phases of *extraneus*." Insufficient data are at hand to re-evaluate the treatment of *C. girardianus*, and Ortmann's designation of this species as a synonym of *C. extraneus* is tentatively accepted. Only one specimen of *Cambarus cornutus* has ever been reported, and since the single individual is morphologically different from its apparent relatives the specific status previously accorded it is accepted here. *Cambarus rusticiformis* appears to be a distinct species, and an appreciable extension of its range is reported below.

The species described here is of considerable interest in that it is the first record of the presence of a member of the Extraneus Section along the eastern slope of the Appalachian system. All of the other species

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are found within the drainage systems of the Alabama, Tennessee, and Ohio rivers. It is of further interest that *C. spicatus* appears to be confined to Little River in Fairfield and Richland counties, South Carolina. While an intensive survey of the Broad River, into which the Little River flows, has not been conducted, several collections are available from each of the counties along its course and all of them contain other species which appear to be vicariants of *C. spicatus*.

I wish to thank Dr. E. C. Raney, Mr. E. A. Crawford, and Mr. T. R. Bello for their assistance in securing the specimens on which this description is based.

*Cambarus spicatus*<sup>1</sup>, sp. nov.

*Diagnosis*.—Rostrum excavate above without thickened margins; margins converge to marginal spines or tubercles which clearly mark the base of the subspiculiform acumen. Areola 3.3-5.0 times longer than broad with five to nine shallow punctations across narrowest part, and constituting 30.3-34.6 per cent of entire length of carapace. A well developed spine present on each side of carapace immediately caudad of cervical groove. Cephalolateral portion of carapace with one or more spines anterior to cervical groove. Suborbital angle with a spine or small tubercle. Postorbital ridges well developed and terminate cephalad in a spine or acute tubercle. Chela broad, depressed, with costate outer margin; a distinct depression above and below base of immovable finger; inner margin of palm with two distinct rows of tubercles; fingers of adults long and gaping. (For pleopods and annulus ventralis, see figures 1, 2, 3, 5, and 10.)

*Holotype Male, Form I*.—Body subovate, somewhat depressed. Abdomen narrower than thorax (17.7 and 20.4 mm. in widest parts respectively). Width of carapace greater than depth in region of caudodorsal margin of cervical groove (19.6 and 16.0 mm.). Greatest width of carapace (20.4 mm.) a short distance caudal to cervical groove. Areola broad (4.6 times longer than wide), with seven small shallow punctations in narrowest portion. Cephalic portion of carapace 1.9 times as long as areola (length of areola 34 per cent of entire length of carapace). Rostrum excavate above; margins convergent and not thickened; long acumen, distinctly set off at base by corneous, acute marginal tubercles, and with an upturned, corneous, spine-like tip. Upper surface of rostrum with the usual submarginal row of setiferous punctations and these rows continue cephalad onto the acumen where the setae form a pubescent coat on the upper surface; suborbital ridges poorly developed and evident in dorsal aspect for only a short distance at base.

Postorbital ridges, moderately well defined and deeply grooved dorsolaterally, terminate cephalically in acute corneous tubercles. Suborbital angle terminates in an acute corneous tubercle. Branchiostegal spine well defined and acute. Lateral surface of carapace strongly granulate and with a prominent spine immediately caudad of cervical groove above which is a single subacute tubercle somewhat larger than neighboring granules; lateral surface anterior to cervical groove with about seven spiniform tubercles, two of which are more conspicuous than others;

<sup>1</sup>*Spicatus*—(*spicus*) L.,—point; so named because of the spines on the cephalolateral portion of the carapace, a unique characteristic of epigeic species of this genus.

upper surface of carapace mostly punctate with a small polished area in gastric region. Abdomen shorter than carapace (36.8 and 38.8 mm.). Cephalic section of telson with two spines in each caudolateral corner.

Epistome (fig. 7) subtriangular with shallow emarginations cephalolaterally; margins not swollen but somewhat elevated (ventrally). Antennules of the usual form with a spine present on lower surface of basal segment. Antennae extend caudad to base of telson. Antennal scale (fig. 4) broadest slightly distad of midlength; outer thickened portion not so broad as lamellar portion and bearing a prominent spine distally.

Left chela depressed with palm slightly inflated; punctate except for upper mesial portion of palm and certain areas of fingers (see below). Outer margin of hand costate. Inner margin of palm with a row of eight tubercles and an additional one slightly below this row at base of distal third; a well defined row immediately above the aforementioned row consisting of seven tubercles. A prominent tubercle on lower surface of palm at base of dactyl. Fingers distinctly gaping. Upper and lower surfaces of dactyl and upper surface of immovable finger with a submedian ridge flanked on both sides by deep punctations. Opposable margin of immovable finger with a row of 12 knob-line tubercles extending from base to distal sixth of finger; the fourth from base conspicuously larger than others; two tubercles occurring just below this row at base of distal fourth of finger; a row of minute denticles present along distal fourth of finger; a number of conspicuous plumose setae at base of finger. Lateral surface of immovable finger costate with a row of squamous tubercles proximally and a row of setiferous punctations distally. Lower surface of immovable finger punctate. Opposable margin of dactyl with a row of 18 knob-like tubercles, the first and fifth from base larger; a row of minute denticles on distal sixth of finger. Mesial surface of dactyl with a number of tubercles on basal third; with a single row on middle third, and a row of setiferous punctations along distal third. (Distal two podomeres of right cheliped abnormal.)

Carpus of cheliped longer than broad and with a well defined longitudinal furrow above; sparsely punctate except laterally. Mesial surface with a single procurved spike-like tubercle (an additional smaller tubercle proximal to it on right cheliped); lower surface with two tubercles on distal margin (right cheliped with an additional one proximomesiad of the more mesial one on lower distal margin).

Merus of cheliped sparsely punctate except on upper distal portion; upper surface mostly rough with two spiniform tubercles somewhat proximad of distal margin; lower surface with a mesial row of nine, mostly spiniform, tubercles and a lateral row of four, only two well-developed (right cheliped with ten and five in the respective two rows).

Hooks on ischiopodites of third pereopods only (fig. 8); hooks strong and simple and tips extend proximad of distal margin of basipodite. Coxopodite of fourth pereopod with a knob-like prominence on caudal mesioventral angle.

First pleopod (figs. 1 and 5) symmetrical and reaching caudal margin of coxopodite of third pereopod when abdomen is flexed; distal portion terminating in two distinct parts. Central projection corneous, blade-like and extending caudal at approximately 90 degrees to the main longi-



tudinal axis of the appendage; tip slightly cleft. Mesial process non-corneous, bulbiform and tapering to blunt tip directed caudolateral at an angle similar to that assumed by central projection.

*Morphotypic Male, Form II.*—Differs from the holotype in the following respects: Subrostral ridges more strongly developed and evident to base of acumen; subacute tubercle above spine on lateral surface of carapace much reduced; opposable margins of both fingers of cheliped with plumose setae that obscure the tubercles; lower mesial row of tubercles on merus consisting of six and lateral of three. Hooks on ischiopodites of third pereopods not reaching proximad to distal end of basipodites. First pleopod (figs. 2 and 3) similar to that of holotype; however, central projection not corneous and much heavier; basipidoischial groove clearly evident in both mesial and lateral aspects. (See measurements.)

*Allotypic Female.*—Differs from the holotype in the following respects: Subrostral ridges better developed than in holotype but not evident to base of acumen as in morphotype; subacute tubercle above spine on lateral surface of carapace not so strongly developed as in holotype; opposable margin of immovable finger with 10 tubercles; opposable margin of dactyl with 12; lower mesial row of tubercles on merus consisting of eight and nine on right and left chelipeds respectively, and lateral row of three and four. Other differences involve only secondary sexual characteristics and measurements (see below). *Annulus ventralis* (fig. 10) subtrapezoidal in outline. Caudal wall high, laterally forming oblique ridges; cephalic half with a median sinus and a low elevation paralleling it one each side; near midlength of annulus the sinus makes a dextral hairpin turn and at the median line turns caudad to the midcaudal margin of annulus; fossa occurs at the hairpin turn.

*Measurements* (in millimeters).—

		Holotype	Allotype	Morphotype
Carapace	Height	16.0	16.1	12.0
	Width	20.4	19.1	14.7
	Length	38.8	38.2	29.9
Areola	Width	2.9	2.8	2.5
	Length	13.2	12.6	9.9
Rostrum	Width	5.2	5.3	4.4
	Length	10.4	10.2	8.3
Chela (Left)	Length of inner margin			
	of palm	10.7	7.5	4.9
	Width of palm	15.6	10.4	6.3
	Length of outer margin			
	of hand	36.2	26.0	18.0
	Length of dactyl	22.8	15.6	11.4

*Type Locality.*—Little River, 10.3 miles west of Winnsboro, Fairfield County, South Carolina on St. Rte. 22. Here the river, some 25 to 30 feet broad, flows with a moderate current over a sand and clay bottom. The river bed is apparently devoid of any attached aquatic vegetation. In the vicinity are *Liriodendron tulipifera*, *Liquidambar styraciflua*, *Ilex* sp., *Ulmus* sp., *Quercus* sp., and *Pinus* sp. On April 18, 1955 the water was somewhat turbid and had a temperature of 20°C. All of the specimens of *C. spicatus* were collected from debris along the margins of the stream.

*Disposition of Types.*—The holotypic male, form I, allotypic female,

and morphotypic male, form II are deposited in the United States National Museum (Nos. 99323, 99324 and 99325 respectively). Of the paratypes, one second form male and one female are deposited in the collection of Dr. George H. Penn at Tulane University; 13 males, form II, 11 females, five juvenile males, and six juvenile females are in my personal collection at the University of Virginia.

*Specimens Examined.*—This species is known from only two localities on Little River in Fairfield and Richland counties, South Carolina. *Fairfield Co.*—The type locality, 3-2851-4 (1 ♂ I, 4 ♀ ♀), E. C. Raney, coll.; 4-1855-6c (6 ♂ ♂ II, 8 ♀ ♀, 1 juv. ♂, 4 juv. ♀ ♀), E. A. Crawford, T. R. Bello, and H. H. H., coll. *Richland Co.*—2.2 mi. WNW jct. of S. C. Rts. 215 and 269, near Richtex. 9-0055-1a (4 ♂ ♂ II, 3 juv. ♂ ♂, 2 juv. ♀ ♀), E. A. C., coll.; 10-3054-1 (5 ♂ ♂ II, 1 ♀, 1 juv. ♂), E. A. C., coll.

*Color Notes.*—*Cambarus spicatus* is one of the more spectacularly colored species of the genus. The background is for the most part a pinkish-tan. The postorbital ridges are conspicuously marked with purplish-brown as is a large symmetrical pair of splotches in the gastric region of the carapace. The lateral portion of the carapace is a grayish-green with a conspicuous pink band extending from just above the suborbital angle ventrally to just below the cephalic extremity of the cervical groove where it turns caudally to follow the groove to the level of the lateral spine on the carapace. Below this pink band on the branchiostegite is a purplish-brown area, the caudal margin of which is marked by a tongue-like cream wedge extending caudodorsally from the ventral margin of the branchiostegite just below the lateral spine of the carapace. The abdomen is also pinkish-tan with bright pink and greenish-brown markings. The cephalic half of the epimera are greenish-brown and the caudal half and margins are pink. The chelae are olive green with pale pink tubercles; the lower tips of the fingers and the lateral margin of the immovable finger are orange in color, and the upper surfaces of the tips of the fingers are scarlet. All of the tubercles are pink or white both on the carapace and chelipeds.

*Relationships.*—*Cambarus spicatus* probably has its closest affinities with *Cambarus extraneus*. There are certain characteristics which suggest a relationship with the members of the *Montanus* group, and it is conceivable that it occupies a somewhat transitional position between the *montanus* and *extraneus* complexes. It may readily be distinguished from all other epigeal members of the genus by the combination of marginal spines on the rostrum and the group of spines on the sides of the carapace anterior to the cervical groove.

*Variations.*—The most conspicuous variations in *Cambarus spicatus* are found in the rostrum. Although marginal spines are always present, the margins may be subparallel, slightly converging, or even slightly biconvex. The acumen may be relatively short with a blunt, slightly upturned apex, or it may be long and spiculiform. As indicated in the diagnosis, the areola ranges from 3.3-5.0 times as long as broad and constitutes from 30.3-34.6 per cent of the entire length of the carapace. The number of punctations across the narrowest part of the areola varies from five to nine.

*Cambarus rusticiformis* Rhoades

This species has been reported previously from tributaries of the Cumberland River in Logan and Trigg Counties, Kentucky (Rhoades, 1944:133). The following three new records extends the known range to the southeast. *Cumberland Drainage*: Little Crab Creek about seven miles west of Jamestown, Fentress County, Tennessee, April 29, 1945 (7 ♂ ♂ II, 3 ♀ ♀, 2 juvenile ♂ ♂, 1 ♀ with eggs), C. S. Shoup and H. H. H., coll.; Poplar Cove Creek, about five miles west of Jamestown, Fentress County, Tennessee, September 21, 1945 (1 ♀), C. S. S., coll. and on October 10, 1948 (1 ♂ I, 4 ♀ ♀), C. S. S., coll.; Rocky River, a tributary of Caney Fork, Van Buren County, Tennessee, August 3, 1951 (1 ♀), John W. Parsons, Coll.

Key to the Species of the Extraneus Section of the Genus *Cambarus*

- 1 Antennal flagellum strongly compressed and bearded on inner margin . . . Green River, Edmonson Co., Kentucky ..... *Cambarus cornutus* Faxon
- 1' Antennal flagellum normal ..... 2
- 2 (1') One to several spines on lateral portion of carapace anterior to cervical groove . . . Little River, Fairfield and Richland Counties, South Carolina ..... *Cambarus spicatus*, sp. nov.
- 2' No spines on lateral portion of carapace anterior to cervical groove ..... 3
- 3 (2') Inner margin of palm of chela with two serrate rows of tubercles; the inner consisting of seven or less in number; lateral spines on rostrum never strongly developed . . . Alabama River system in N.W. Georgia and N.E. Alabama ..... *Cambarus jordani* Faxon
- 3' Inner margin of palm of chela with two rows of tubercles; neither row serrate and inner row usually consisting of eight or more; lateral spines on rostrum usually well developed ..... 4
- 4 (3') Rostrum less than one-fourth total length of carapace . . . Cumberland River system from Fentress Co., Tenn. to Trigg Co., Kentucky ..... *Cambarus rusticiformis* Rhoades
- 4' Rostrum more than one-fourth total length of carapace . . . Alabama and Tennessee drainage systems in Georgia, Alabama, Tennessee, and Kentucky ..... *Cambarus extraneus* Hagen

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## Explanation of Plate

*Cambarus spicatus*

Fig. 1. Mesial view of first pleopod of male, form I.

Fig. 2. Mesial view of first pleopod of male, form II.

Fig. 3. Lateral view of first pleopod of male, form II.

Fig. 4. Antennal scale of male, form I.

Fig. 5. Lateral view of first pleopod of male, form I.

Fig. 6. Lateral view of carapace of male, form I.

Fig. 7. Epistome of male, form I.

Fig. 8. Basipodite and ischiopodite of third pereopod of male, form I.

Fig. 9. Distal podomeres of cheliped of male, form I.

Fig. 10. Annulus ventralis.

Fig. 11. Dorsal view of carapace of male, form I.

